Space Weather Technical Forecast

Issued on Tuesday, 20 February 2024 at 13:13 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Ongoing Chance of R1. Slight Chance G1 Friday 23rd February.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has remained Low over the UTC day of Monday 19 February with X-ray flares at GOES16 confined to C-class, peaking with a C5.7 flare at 20/1240UTC from AR3590 near the eastern solar horizon.
There are four sunspot regions on the visible disc, with the nominal threat of flares dominated by AR3590 in the northeast as an Ehi/Beta-Gamma. Other sunspots were relatively magnetically simple and largely unchanged in the 24 hours.
At the time of writing, no Earth-directed Coronal Mass Ejections (CMEs) were noted.
Solar Wind / Geomagnetic Activity: Solar winds, as recorded at L1 by ACE and DSCOVR, were reflective of a slow solar wind regime. The solar wind speed was steady at Background levels between 275 and 325km/s. The solar wind density was between average and below average. The IMF was mostly smooth and stable below 8nT, with a largely negative Bz component, finishing at -6nT at 20/1200UTC. The phi angle was positive (away from the Sun) for the vast majority of the period but did have some brief intervals of negative (towards the sun) through the morning of the 20th Feb.
The net result of the above solar wind measures was for provisionally Quiet geomagnetic activity throughout, with Kps of 0 or 1.
Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was just above resting background levels but on a slowly declining trend.
Electron flux (greater than 2MeV) has been at Normal Background levels, with electron fluence well below the Active (1e8 integrated pfu) threshold. The observed 24-hour fluence at 20/0001UTC was 1.1e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is most likely to continue, but with a daily Chance of rising to Moderate. This chance is rated roughly constant through the four days, with arriving eastern limb regions roughly compensating for western limb losses.
Solar Wind / Geomagnetic Activity: Solar wind speeds are expected to remain mostly at ambient levels, however CH91 is expected to connect with earth late on day 4 (23rd Feb), which may cause solar wind speeds to rise to Slightly elevated or elevated levels.
Geomagnetic activity is forecast to be mainly Quiet, with a Slight Chance of active or perhaps G1/Minor Geomagnetic storm intervals late on the 23rd February
Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux will continue to gradually ease to Background, but with a Slight Chance of further enhancement until around midweek UTC should any appropriate flares occur from AR3576 just over the limb or from AR3583 approaching it.
High energy electron flux (greater than 2MeV) is expected to remain at Normal Background levels. The associated 24-hour electron fluence is expected to stay below the Active threshold.

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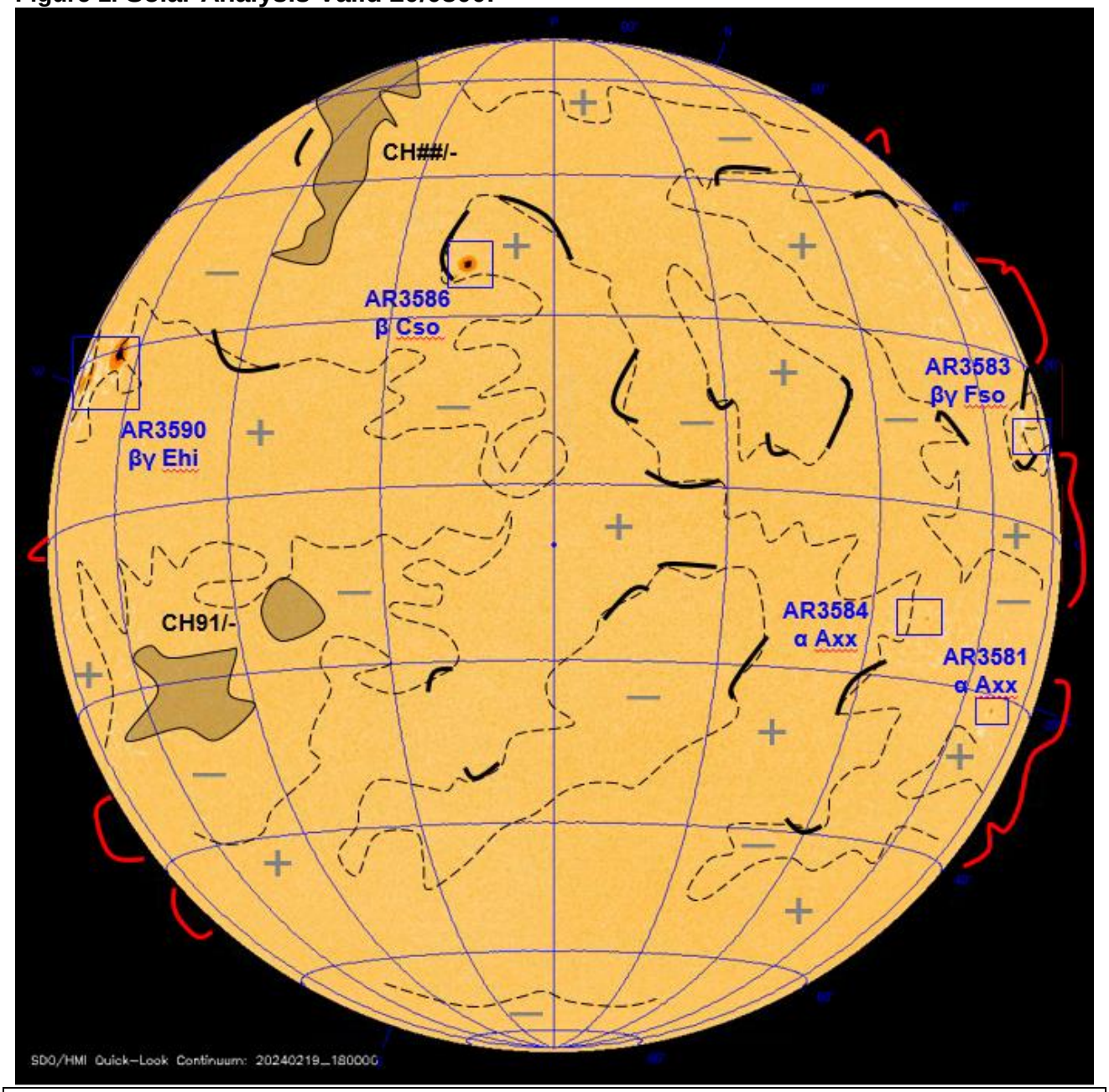
Figure 1. Solar Analysis Valid 20/0800.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

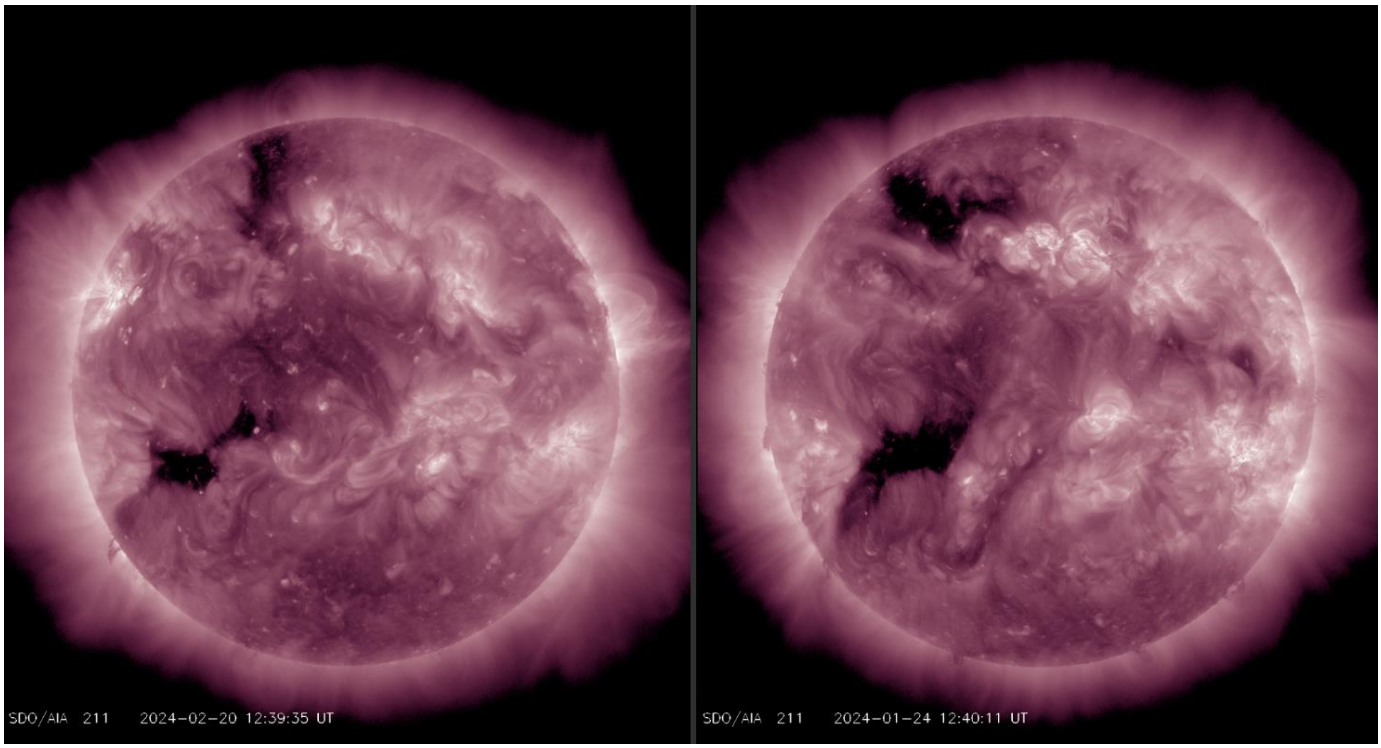
There are no earth bound CME's in the forecast

Solar wind speeds are expected to remain at ambient levels through the majority of the UTC working week. However CH91 may cause some slight enhancement on Day 4 (23rd Feb) and enhance winds to slightly elevated or elevated levels, but this feature did not cause any major enhancement on its previous rotation when it appeared larger and darker than it currently does.

Geomagnetic activity is forecast to be mainly Quiet, with a Slight Chance of Active or perhaps G1/Minor Geomagnetic Storm intervals late on the 23rd February due to interaction with CH91.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	15
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Current and previous rotations' coronal hole configurations, as seen on AIA211.



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Radio Blackouts - X-Ray Flares:

Low solar activity is most likely through the period, but with an increasing likelihood of Moderate activity, due to a large contribution from AR3590 near the eastern limb, and perhaps soon Ex-AR3575 and EX-3569 which is also expected to rotate onto the southeast limb from around 21 February. These regions should theoretically make up for the shortfall of AR3583's recent passing onto the far side, and hence a steady trend of a Chance of M-class flares is maintained through the next four days. Having said this, the character of AR3590 has yet to be fully determined, and some revision of the level of the advertised flat risk is possible once AR3590's behaviour becomes more fully known, i.e. not relying solely on its Zurich class.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	35	35	35	35
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: GOES 16/18 24 Hour X-ray Flux:

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Solar Radiation Storms - (High Energy Protons):

GOES18 high energy (greater than 10MeV) protons have continued their gradual decline towards resting background levels in the past 24 hours, with no new enhancements seen since 16 February.

AR3576 will now give a decreasing risk for further proton enhancements as it's moved just over the western limb. Remaining regions on the Earth-facing disc have a lower chance of notable flares, and are currently considered unlikely sources of further solar storms, with the nominally more potent AR3590 currently not in favourable location to connect with Earth should it flare appropriately on the eastern limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	2	2	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to be muted through much of the period, with no recurrent feature on the disc having proved capable of generating Active fluence in the past rotation. The only source of enhancement possible in the period is the connection with CH91 late on Day 4 (23rd Feb), but this is likely to have limited charging of the electron belts. MOSWOC REFM is also not indicating any significant enhancement in the period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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